

**A survey of medical literature trying to answer the question: "What percentage of men have sperm that survives the freezing process well enough to meet minimum fertility standards?"** by F. Strauss, MD; S. Blandon, MD and L. Traiman, FNP

It is generally agreed upon that the freezing process decreases human sperm motility. But the question remains by how much. There seems to be little data from peer reviewed journals which can answer the question: "What percentage of men have sperm that survives the freezing process?" Most health professionals involved in recruitment of sperm donors will answer this question with a variation between one in ten to one in four. Other health professionals, unacquainted with sperm banking, are confident in the widely held misconception that cryosurvival is much higher and they claim a minimal amount is lost. By looking at the literature that does exist from peer reviewed journals we have tried to get an overall answer to this question.

We have identified 5 studies that give us information to answer our question. The first study only looks at the effects of cryopreservation on sperm. That study looks at men with higher than average sperm counts whose sperm has already been determined to survive the freezing process in sufficient quantity that they are already donors. This study does not help answer our question directly but gives us insight into the detrimental effects that cryopreservation has on sperm.

The remaining 4 studies look at the difficulty of recruiting anonymous sperm donors for donor insemination programs in sperm banks. The second study was a survey of many of the United Kingdoms fertility centres and do not supply specific numbers of how many sperm sample were examined. None-the-less, some of the information reported by many of their centres reporting poor initial semen quality and cryosurvival is also helpful in giving us a general direction for answering our question.

The last 3 studies do give specific numbers of sperm samples analysed and number of those accepted and eliminated because of poor initial semen quality and poor cryosurvival. For our purposes, these can be systematically summarized by answering the following 3 questions:

**Summary Questions**

- 1. What is the number of sperm samples examine?**
- 2. How many had cryosurvival good enough to be used for insemination? (number and percentage of total)**
- 3. How many were eliminated due to poor initial sperm quality and poor cryosurvival?**

1. **Effect of cryopreservation on the motility characteristics of human spermatozoa** by B. A. Keel, B. W. Webster and D. K. Roberts Journal of Reproduction and Fertility 1987 81, 213-220

This study looks at the decrease in sperm quality of men who have higher than average sperm counts and have already shown that their sperm survived the freezing process well enough to use for insemination. Indeed, they are described as already "serving on an AID (alternative insemination by donor) panel." They reported:

"Cryopreservation resulted in significant ( $P < 0.01$ ) reduction in velocity, motility, motility index and motile density."

"In the present study, the post-thaw motile density was only 35% of the prefreeze value. Taken together, these studies indicate a 60% loss of the number of motile spermatozoa as a result of cryopreservation."

It is important to note that this "significant reduction" did not mean that these donations were not acceptable for insemination as these donors had high initial counts. However, it is indicative of the effects of cryopreservation on all sperm.

## **2. A survey of semen donation: phase I-the view of UK licensed centres**

by Susan Golombok and Rachel Cook Human Reproduction vol.9 no.5 pp.882-888, 1994

This study primarily examined the overall difficulties in recruiting anonymous sperm donor so the question we are looking at was not directly addressed. This skews the study in favor of a younger, and presumably more fertile, population. They reported:

"The most common reasons for rejecting potential donors were associated with poor sperm quality. Almost all centres (94%) reported losing potential donors due to low sperm count, poor motility or sperm abnormality, and with 17% of centres losing over two-thirds of potential donors for these reasons and a further 26% losing between one and two-thirds of men who undergo screening."

As they stated, 43% of fertility centres had at least one third to over two-thirds of men with sperm quality so poor that they did not even attempt to freeze their sperm. The study additionally reports:

"Poor motility following thaw results in further loss of >10% of potential donors in 55% of centres and an additional 33% of centres lose up to 10% of potential donors this way."

Therefore, of those whose sperm samples had high enough quality and quantity to attempt a freeze, an additional number of samples (about 10%) were lost due to the freezing process.

This does not exactly answers the question, "What percentage of men have sperm that survives the freezing process?", however, it does give us a direction.

Additionally, it gives us insight into why some health professionals, not personally acquainted with this field, may harbor the misconception of high cryosurvival rates. Those who do not practice in this area may simply look at the additional 10% loss of initially high quality sperm sited here and focus on that number. They may mistakenly use that 10% figure and inappropriately assign it to all men.

3. **A protocol for the recruitment and screening of semen donors for an artificial insemination by donor programme** by M. Chauhan, C. L. R. Barratt, S. Cooke, I. D. Cooke Human Reproduction 1988; 3:873-876

This study comes closer to answering our initial question: "What percentage of men have sperm that survives the freezing process?" However, once again the sample population is skewed towards younger men. Recruiting was done by advertisements "in the student press, poster in the University and Polytechnic and advertisements in the local newspapers" and are described as "mainly single students". They recruited 191 donors to be screened. Their results are:

"Only semen samples from 161 prospective donors were analysed. 113 (59%) prospective semen donors were rejected after semen analysis."

That is 59% of the total number of 191 recruits. 30 of whom never had their semen analysed and should not be counted for answering our primary question of "What percentage of men have sperm that survives the freezing process?" Of the 161 who's sperm was analysed over 70% or 113 were rejected.

Although this was a British study the authors state:

"Our acceptable semen criteria are similar to those recommended by the American Fertility Society (1986) and other authors (Corson,1980: Bordson et al., 1986) (Table I). The majority of the potential donors were rejected on the basis of poor post-thaw motility."

### **Summary Questions**

1. **What is the number of sperm samples examine? 161**
2. **How many had cryosurvival good enough to be used for insemination? (number and percentage of total) 48 (29.8%)**
3. **How many were eliminated due to poor initial sperm quality and poor cryosurvival? 113 (70.2%)**

4. **Causes of donor rejection in a sperm banking program** by M. Schroeder-Jenkins, S. A. Rothman Fertility and Sterility 1989; 51(5): 903-906

This study, like the previous study, is skewed towards a younger population as the median age is 24.

Of the 93 men recruited 36 were eliminated prior to semen analysis. Of the 57 men whose semen was analyzed 13 were rejected by initial semen analysis. Of the 44 men whose sperm was frozen 12 were eliminated because of "poor cryosurvival". Therefore, of the 57 men whose sperm was analyzed 32 (56%) had acceptable cryosurvival.

This study also may contribute to the confusion surrounding our initial question when they state:

"Unfortunately, sperm from many men do not survive the freezing process. In our experience, 12 of 44 otherwise acceptable donors (27%) were rejected because of poor cryosurvival, causing an additional and significant loss of sperm donors."

Although, they refer to 27% (12) as a "significant loss" they have not factored in the 13 men whose sperm quality was so poor that a freeze was not even attempted. Therefore, the loss of donors due to quality and cryosurvival is 25 of 57 or 44%.

### **Summary Questions**

- 1. What is the number of sperm samples examine? 57**
- 2. How many had cryosurvival good enough to be used for insemination? (number and percentage of total) 32 (56%)**
- 3. How many were eliminated due to poor initial sperm quality and poor cryosurvival? 25 (44%)**

5. **Reasons for Rejecting Potential Donors from a Sperm Bank Program** by R. S. Sidhu, R. K. Sharma, S. Kachoria, C. Curtis, A. Agarwal Journal of Assisted Reproduction and Genetics 1997; 14(6): 354-360

This study showed the highest cryosurvival rates. However, once again the sample is skewed towards a younger population with an upper age limit of 32 and a median age of about 26.

They recruited 199 men. Of those 121 were rejected or dropped out after the interview and questionnaire. Seventy-eight (78) went on to have semen analysis done and 25 (32%) were rejected for poor semen quality. It is unclear if all rejections for poor semen quality were due to initial semen analysis or post-thaw analysis. Twenty-five (25) were ultimately accepted as donors.

Two comments from their discussion are worth noting:

"Poor sperm count and motility in otherwise acceptable donors were the most common reasons for rejection of potential donor."

"Poor cryosurvival also reduces the number of donors."

### Summary Questions

1. What is the number of sperm samples examine? 78
2. How many had cryosurvival good enough to be used for insemination? (number and percentage of total) 53 (68%)
3. How many were eliminated due to poor initial sperm quality and poor cryosurvival? 25 (32%)

### Discussion:

"What percentage of men have sperm that survives the freezing process well enough to meet minimum fertility standards?"

The cumulative total of the last 3 studies is:

1. What is the number of sperm samples examine?  $161+57+78=296$
2. How many had cryosurvival good enough to be used for insemination? (number and percentage of total)  $48+32+53= 113 (45\%)$
3. How many were eliminated due to poor initial sperm quality and poor cryosurvival?  $113+25+25=163 (55\%)$

As documented in the above studies, cryopreservation of human semen significantly decrease the number of potential donors even among young populations. Cryosurvival rates vary widely from study to study from 30% to 68%. It should also be noted that regardless of whether a particular semen sample meets minimal fertility criterion after cryopreservation and thaw, it's reproductive potential is greatly diminished by the process. This was most clearly seen in **Effect of cryopreservation on the motility characteristics of human spermatozoa** when they stated, "Cryopreservation resulted in significant reduction in velocity, motility, motility index and motile density."

The evidence presented by these studies supports the complaints of poor semen quality and cryosurvival by those in the field of sperm banking. However, a more systematic survey of sperm banks or a prospective study specifically examining this question must be done to answer this question more accurately. Also, the overwhelming number of the men observed in these studies were under 35. Because many older men, into their 50's, are being asked to become directed donors, a wider age range must be included to answer this question for those 35 and older.